

# PATENT SPECIFICATION

## DRAWINGS ATTACHED

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### COMPLETE SPECIFICATION

#### Improvements relating to Basic Refractory Bricks

I, RUSSELL PEARCE HEUER, of 1241, Ridgewood Road, Bryn Mawr, in the County of Montgomery and Commonwealth of Pennsylvania, United States of America, a Citizen of the United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention concerns improvements relating to basic refractory bricks.

Extensive use is being made in refractory furnace roofs and other constructions of basic refractory bricks provided with oxidisable metallic plates on the outside of, and in some cases also inside, the bricks.

The plates are usually of steel, preferably plain carbon steel such as AISI 1010 or 1035 or suitably low alloy steel. The plates are normally in the range of thickness from 1/32" to 1/4", and are suitably affixed to the refractory of the brick. In furnace use the plates oxidise and react with the refractory, improving the behaviour of the refractory roof as a whole.

An object of the present invention is to provide an improved construction of metal-clad brick, and method of manufacture thereof, with a view of securing plates firmly to the brick whilst substantially avoiding the use of double thicknesses of metal plate and thus avoiding likelihood of metal melting and leaving the joint between adjoining bricks rather than oxidising and reacting with the refractory.

According to one aspect of the invention, a basic refractory brick comprises a body consisting substantially of basic refractory material, a first oxidisable metallic plate co-moulded with such body or a part of such body and extending on one lateral face of the body with portions or tabs lying in only a small unsubstantial area of an adjacent lateral face of the body, and a second and distinct

oxidisable metallic plate extending on such adjacent face and secured to the first plate at the tab portions.

Preferably the first plate extending on one lateral face of the body has the portions or tabs lying in two adjacent lateral faces of the body, and the second plate is U-shaped with the base extending on the lateral face of the body opposite the face on which the first plate extends and with the arms of the U extending on the adjacent lateral faces in which the tab portions of the first plate lie.

According to another aspect of the invention, a method of making a refractory brick provided with external plate on all four lateral faces, comprises co-moulding an oxidisable metallic plate with a basic refractory mass to form an intermediate brick having the plate extending over a major portion of one lateral face with portions or tabs lying in only a small unsubstantial area of the surface on two lateral faces adjacent the one lateral face, enclosing the intermediate brick in a second oxidisable metallic plate of U-shape, the base of the U of the second plate being placed on a lateral face of the intermediate brick opposite to the one lateral face on which the co-moulded plate extends with the arms of the U of the second plate extending over the said two lateral faces of the intermediate brick on the outsides of the tab portions of the co-moulded plate, and then fastening the arms of the second plate to the tab portions of the co-moulded plate.

According to a further aspect of the invention, a method of making a refractory brick provided with external plate on all four lateral faces, comprises co-moulding a first oxidisable metallic plate with a basic refractory mass to form a first intermediate brick having the plate extending over a major portion of one lateral face with portions or tabs lying in the surface on two lateral faces adjacent the one lateral face, moulding a second intermediate brick of basic refractory material

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and of substantially the same dimensions as the first intermediate brick, placing the two intermediate bricks together with a lateral face of one abutting a lateral face of the other and enclosing them in a second oxidisable metallic plate of U-shape, the base of the U of the second plate being placed on a lateral face of the second intermediate brick opposite to the said one lateral face of the first intermediate brick with the arms of the U extending over adjacent lateral faces of both the first and second intermediate bricks on the outsides of the tab portions of the first plate, and then fastening the arms of the second plate to the tab portions of the first plate.

Some embodiments of brick and their method of manufacture according to the invention are hereinafter described, by way of example with reference to the accompanying drawings, in which:—

Figure 1 is a plan view of a blank from which an external plate to be co-moulded with refractory is formed,

Figure 2 is a perspective view of one form of such plate,

Figure 3 is a perspective view of a variant plate,

Figure 4 is a diagrammatic vertical section showing the co-moulding of refractory material with the plate shown in Figure 2,

Figure 5 is an exploded perspective view showing the application of a second external plate to the intermediate brick thus produced.

Figure 6 is a perspective view of the finished brick,

Figure 7 is a section of the finished brick on the lines 7—7 of Figure 6,

Figure 8 is a cross section of another embodiment of a finished brick,

Figure 9 is an exploded perspective view showing the application of a second external plate to complete the brick shown in Figure 8,

Figure 10 is a perspective view of this brick in its finished form, and

Figure 11 is a section on the line 11—11 of Figure 9.

Figures 1 and 2 show an oxidisable metallic plate 20 which in Figure 1 is in the form of a blank having a main portion 21 which is intended to extend along the length of one lateral surface of a brick, or at least the major portion thereof, and having projecting portions or tabs 22 which are adapted to be bent suitably to an angle somewhat greater than a right angle with respect to the main portion 21 as shown in Figure 2.

Projections 23 are punched out from the main portion 21 so as to be capable of being embedded in the refractory of the brick by co-moulding.

The plate 20 is placed as shown in Figure 4 resting on the bottom die 24 of a mould with the tabs 22 extending upward and the

projections 23 extending upward. The width of the main portion 21 is slightly narrower than the mould and the upper ends of the tabs 22 spring engage with the side walls 25 of the mould.

A mass of basic refractory material 27 is then placed in the mould. The refractory material may be any suitable basic refractory, e.g., chrome-magnesia or magnesia-chrome.

An upper die 26 of the mould and the lower die 24 are then moved relatively together, applying a moulding pressure which should exceed 3000 psi and preferably should exceed 10,000 psi or 15,000 psi. The effect is to produce an intermediate brick 28, as shown in Figure 5, which has the plate 20 co-moulded with a refractory body with the tabs 22 at the outside extending only a short distance up the lateral faces 30, suitably not more than one-fourth of the height of the lateral faces. The main portion 21 covers substantially all of the major lateral face 31, and it should in any case cover at least the major portion of such face. It will also be noted that the tabs 22 are separated in this preferred embodiment by refractory areas 32 where no tabs are present at each one of the faces 30.

Although the angle of the tabs to the main portion 21 exceeded 90° as shown in Figure 4 prior to moulding and the width of such main portion is slightly narrower than the intended corresponding face dimension of the intermediate brick to be formed, during moulding the tabs are formed at right angles to the main portion, as appears in the formed intermediate brick, as a result of the moulding pressure. The projections 23 of course are firmly embedded in the interior of the brick by the co-moulding.

In some cases it is desirable to use an internal plate co-moulded with the refractory. Figure 3 illustrates an internal oxidisable metallic plate 33 of U-shape having a base 34 which is united, e.g., by spot welding as shown at 36, to the main portion 31 of the plate 20 and having arms 35 which are embedded in the interior of the brick. In this case, no projections such as 23 need be provided.

A second external oxidisable metallic plate 37 which is of U shape in end elevation or in section is applied to the exterior of the intermediate brick. The plate 37 has a base 38 of the U, which covers the lateral face 40 of the intermediate brick which is opposite to the lateral surface 31, and also has arms 41 of the U which cover, suitably entirely, the lateral faces 30. In any case, when the plate 37 is applied to the brick the base 38 of the U should cover at least a major portion of the face 40 and the arms 41 should cover at least major portions of the faces 30.

The arms 41 extend on the outside of the

tabs 22 and are united to the tabs, e.g., by spot welding as indicated at 42 in Figures 6 and 7.

5 As a result the plate 37 is firmly united to the co-moulded plate. Also, double thicknesses of metal plate occur only at the tabs 22 which constitute only a small unsubstantial area of each lateral face in which they lie.

10 Figures 8 to 11 show a second embodiment of brick in which the body of the brick is constituted by two intermediate brick parts. In making this brick, a first intermediate brick 28 is moulded as described above with reference to Figure 4, with the oxidisable metallic plate 20, including the tabs 22 and projections 23, except that an oxidisable metallic plate 43 is also co-moulded with the refractory material with projections 43' punched out of the plate and extending into the refractory and embedded therein by the co-moulding. The plate 43 is suitably held against the die 26 (Figure 4) by magnetic means (not shown) prior to moulding and the die 26 is provided with a projection (not shown) to produce a corresponding hanger-engaging recess 44 in the moulded intermediate brick.

20 A second intermediate brick 45 is moulded of the same dimensions as the first intermediate brick and having a corresponding hanger-engaging recess 44 but consisting wholly of refractory material and having no co-moulded plates.

35 The two intermediate bricks are then placed together as shown in Figure 9, with the lateral face of the intermediate brick 28' containing the plate 43 abutting a lateral face of the other intermediate brick 45, and with the recesses 44 co-operating to retain a T-shaped hanger 46 which projects from one end of the finished brick. An oxidisable metallic plate 47 of U-shape, similar to the plate 37 except in its dimensions, is then applied to the assembly with each of its arms 48 extending over adjacent lateral faces 49 and 50 of both intermediate bricks and outside the tabs 22, to which such arms are secured, e.g., by spot welding at 42 (Figure 10) as described above. The hanger 46 serves positively to prevent longitudinal displacement of the intermediate brick 45 with respect to the remainder of the assembly, in addition to the frictional engagement of the U-shaped plate 47 therewith.

55 The resulting brick is similar to the brick described with reference to Figures 1 to 7, except that it will generally be, as shown, nearer square section, it includes a hanger, and it embodies the oxidisable metal plate 43 embedded in the complete brick parallel with the main portion of the external plate 20. The plate 43 preferably extends as shown for the preponderant part of the length of the brick but leaving space at the one end of the brick for the hanger.

It will be clear that a similar effect could be achieved by combining one intermediate brick such as 28, i.e., having only the plate 20 co-moulded therewith, with another intermediate brick such as 45 but having the plate 43 co-moulded with it. Another method of securing a plate such as 43 between the abutting lateral faces of two intermediate bricks is simply to use a flat plate, without the projections 43', and secure it in place by a suitable adhesive.

The term "co-moulded" or "co-moulding" as applied herein to a plate is intended to mean that the plate is affixed to the refractory material during the moulding of such material and by the moulding pressure.

#### WHAT I CLAIM IS:—

1. A basic refractory brick comprising a body consisting substantially of basic refractory material, a first oxidisable metallic plate co-moulded with such body or a part of such body and extending on one lateral face of the body with portions or tabs lying in only a small unsubstantial area of an adjacent lateral face of the body, and a second and distinct oxidisable metallic plate extending on such adjacent face and secured to the first plate at the tab portions.

2. A brick according to Claim 1, wherein the first plate extending on one lateral face of the body has the portions or tabs lying in two adjacent lateral faces of the body, and the second plate is U-shaped with the base extending on the lateral face of the body opposite the face on which the first plate extends and with the arms of the U extending on the adjacent lateral faces in which the tab portions of the first plate lie.

3. A brick according to Claim 1 or 2, wherein the second plate is secured to the first plate by welding.

4. A brick according to any one of Claims 1 to 3, wherein the first plate is provided with formations projecting into the refractory material and embedded therein by the co-moulding.

5. A brick according to Claim 4, wherein the formations projecting into the refractory material are comprised in a third oxidisable metallic plate of U-section, the base of the U extending along and secured to the first plate with the arms of the U extending into the refractory material substantially at right angles to the base.

6. A brick according to any one of Claims 1 to 4, wherein the first plate is co-moulded with one part of the refractory body and extends over one lateral face of that part and the or each adjacent lateral face of the body over which the second plate extends is constituted by another lateral face of such one part of the body and an adjacent lateral face of another part of the body.

7. A brick according to Claim 6, wherein a third oxidisable metallic plate is secured

between the parts of the refractory body so as to extend within the brick for a preponderant part of the length of the brick and parallel with the first plate.

- 5 8. A brick according to Claim 6 or 7, wherein the two parts of the refractory body are formed with hanger-engaging recesses which co-act to retain a T-shaped hanger projecting from one end of the brick.

- 10 9. A method of making a refractory brick provided with external plate on all four lateral faces, comprising co-moulding an oxidisable metallic plate with a basic refractory mass to form an intermediate brick having the plate extending over a major portion of one lateral face with portions or tabs lying in only a small unsubstantial area of the surface on two lateral faces adjacent the one lateral face, enclosing the intermediate brick in a second oxidisable metallic plate of U-shape, the base of the U of the second plate being placed on a lateral face of the intermediate brick opposite to the one lateral face on which the co-moulded plate extends with the arms of the U of the second plate extending over the said two lateral faces of the intermediate brick on the outsides of the tab portions of the co-moulded plate, and then fastening the arms of the second plate to the tab portions of the co-moulded plate.

- 30 10. A method of making a refractory brick provided with external plate on all four lateral faces, comprising co-moulding a first oxidisable metallic plate with a basic refractory mass to form a first intermediate brick having the plate extending over a major portion of one lateral face with portions or tabs lying in the surface on two lateral faces adjacent the one lateral face, moulding a second intermediate brick of basic refractory material and of substantially the same dimensions as the first intermediate brick, placing the two

intermediate bricks together with a lateral face of one abutting a lateral face of the other and enclosing them in a second oxidisable metallic plate of U-shape, the base of the U of the second plate being placed on a lateral face of the second intermediate brick opposite to the said one lateral face of the first intermediate brick with the arms of the U extending over adjacent lateral faces of both the first and second intermediate bricks on the outsides of the tab portions of the first plate, and then fastening the arms of the second plate to the tab portions of the first plate.

- 55 11. Method according to Claim 10, wherein the intermediate bricks are moulded with hanger-engaging recesses and a T-shaped hanger is introduced between the intermediate bricks for retention by such recesses prior to fitting the second plate.

- 60 12. Method according to Claim 10 or 11, wherein a further oxidisable metallic plate is secured between the abutting faces of the intermediate bricks.

- 65 13. Method according to any one of Claims 9 to 12, wherein the arms of the second plate are secured to the tab portions of the co-moulded or first plate by welding.

- 70 14. A basic refractory brick constructed substantially as hereinbefore described with reference to and as illustrated in Figures 1 to 7 or Figures 8 to 11 of the accompanying drawings.

- 75 15. A method of making a refractory brick carried out substantially as hereinbefore described with reference to Figures 1 to 7 or Figures 8 to 11 of the accompanying drawings.

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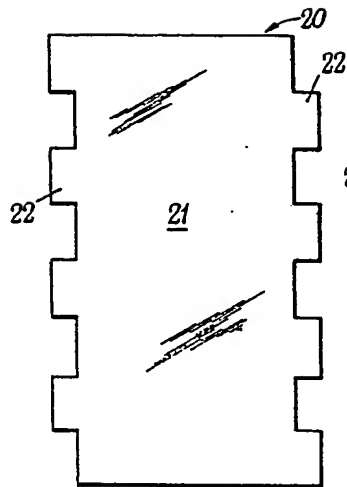


FIG. 1

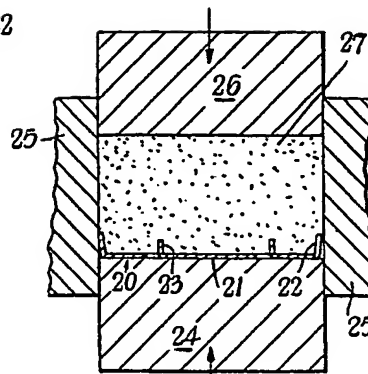


FIG. 4

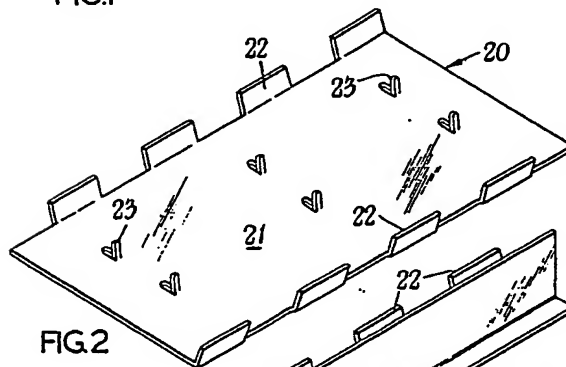


FIG. 2

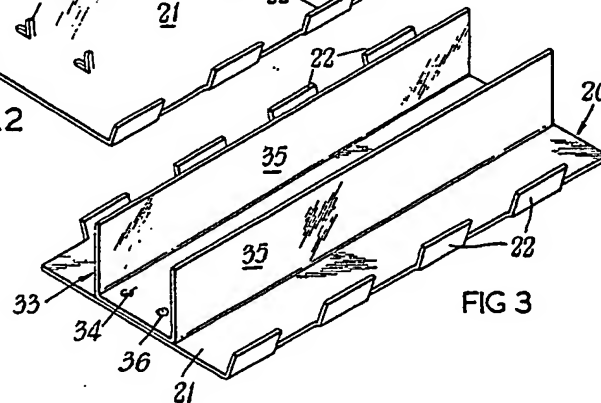


FIG. 3

